THE WEATHER AND CIRCULATION OF JUNE 1958 [1]

Record Cold in Northeast and Warmth in Northwest

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1. WEATHER HIGHLIGHTS

Some of the important weather highlights of June 1958 over the United States were record-breaking cool conditions in many parts of the Northeast, particularly southern New England; heavy rains and floods in the Wabash Basin of Indiana; flooding rains associated with the first tropical storm of the season in southern Texas; severe tornado activity in the central and north-central States, particularly Wisconsin; and a record-breaking cool snap late in the month with the lowest June temperatures on record at many Texas locations.

2. GENERAL CIRCULATION

June 1958 was characterized by slightly above normal speed of the mid-latitude westerlies at 700 mb. in the Western Hemisphere, and in this sense was a continuation of the state achieved during May [1]. During May the circulation recovered from the prolonged index cycle which had influenced the weather over North America and adjacent oceans since mid-winter. However, in June the maximum westerlies receded southward from the high latitude of 47°N. reached during May, and this was accompanied by a general cooling relative to normal over most of the country.

The most important departures of the June 1958 circulation (fig. 1) from the normal pattern were:

(1) The strongly developed ridge from the Beaufort Sea southward into the eastern lobe of the Pacific subtropical high cell northeast of Hawaii. North of 50° N., this position represented a marked retrogression of the ridge normally located over Alberta, and south of 50°N. it represented an intensification of a feature barely discernible on the normal map [2] but well marked on charts showing the geographical frequency of 30-day mean ridges [3].

(2) The cyclonic center of action over Hudson Bay, which had a marked southward displacement from its normal location over the northern part of Baffin Island.

(3) The central Pacific trough, which tilted southeastward toward Hawaii, thereby tending to split the Pacific subtropical ridge into two cells.

(4) A trough in the eastern Atlantic, not normally present except along the coast of Africa, south of a depressed Icelandic Low.

The 700-mb. height departures from normal in figure 1 show a band of above normal heights with maxima in north-central Eurasia, Greenland, the Beaufort Sea, and the Gulf of Alaska. This band of positive height anomaly at high latitudes was a manifestation of blocking, a phenomenon normally associated with depressed centers of action and westerlies south of normal. Figure 2 shows the distribution of average wind speeds and the location of the axes of maximum speed for June 1958, with the principal axis of May 1958 superimposed as a dashed line for comparison. A southward displacement of maximum westerlies from May to June is indicated. An important feature of this chart is the split wind-speed axis in the northeastern Pacific associated with the block in the Gulf of Alaska. Downstream the confluence of these axes in the middle Mississippi and Ohio Valleys played an important part in the excessive rains and severe weather in these areas.

The widespread area of negative height departure associated with the depressed center of action at 700 mb. over Hudson Bay was reflected on the mean sea level chart (Chart XI) as a Low centered over Quebec instead of in the normal June position off the coast of Labrador. An additional feature of importance is the channel of low pressure on the mean sea level chart eastward from Labrador to the southern British Isles, indicating the prevailing storm track for the month. Normally this channel of low pressure is oriented northeastward north of the British Isles.

3. EVOLUTION OF THE CIRCULATION PATTERN

One of the major differences between the circulation in June (fig. 1) and the previous month [1] was the addition of a major trough in the central Pacific. As a block in the Siberian Arctic broke down during the first part of May the westerlies intensified in northeastern Siberia, forcing a major trough from Kamchatka eastward into the central Pacific. This trough was most strongly developed during the first half of June, as can be seen in figure 3 which shows the two 15-day averages which constituted the

[1] See Charts I–XVII following p. 244 for analyzed climatological data for the month.

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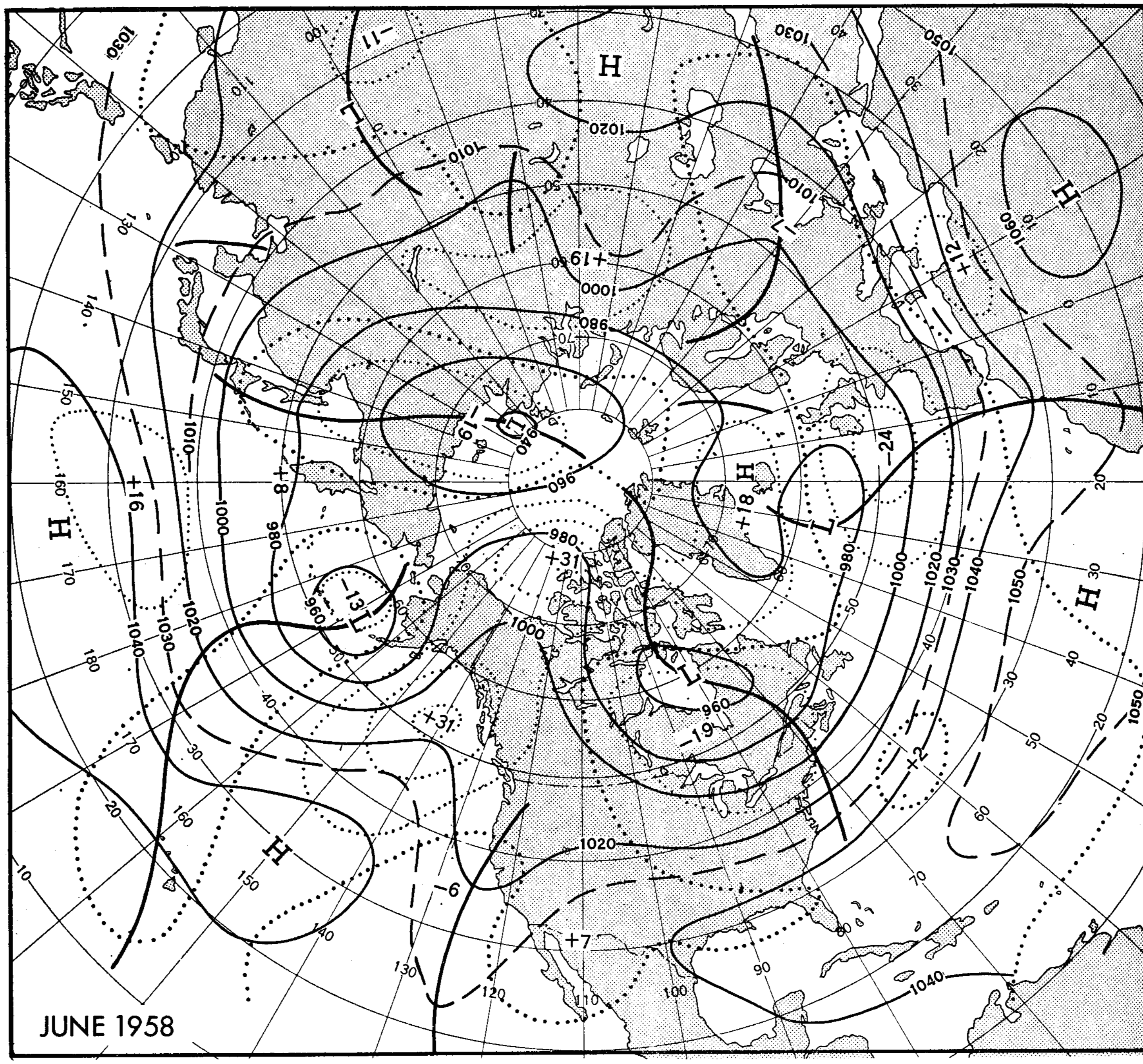


FIGURE 1.—Mean 700-mb. height contours (solid) and departures from normal (dotted) (both in tens of feet) for June 1958. Main features over North America were deep trough in East and confluence over western and central sections.

monthly mean 700-mb. circulation. The resultant shortening of the wavelength probably contributed to moving the eastern Pacific trough closer to the west coast of the United States than it had been during May. The strong blocking that persisted in the Gulf of Alaska tended to keep the coastal trough deeper than normal and temperatures over the interior of California below normal.

One of the most important features of the June circulation, a channel of negative anomaly from California to the Great Lakes, was primarily characteristic of the first half of the month (fig. 3A). It was a manifestation of a channel of cyclonic vorticity associated with a jet axis from southern California to the middle Mississippi Valley (fig. 2). This jet was much more strongly developed at the normal level of the jet core (about 200 mb.) than appears in figure 2. In fact, at 200 mb. the speed maximum over southern California averaged about 30 meters per second for the month, compared to 32 meters per second in the primary maximum which stretched from the middle Mississippi Valley to southern New England. It should also be noted that the southwestern jet maximum would show up even more strongly on a mean chart of the first 15 days, as can be deduced by comparing figure

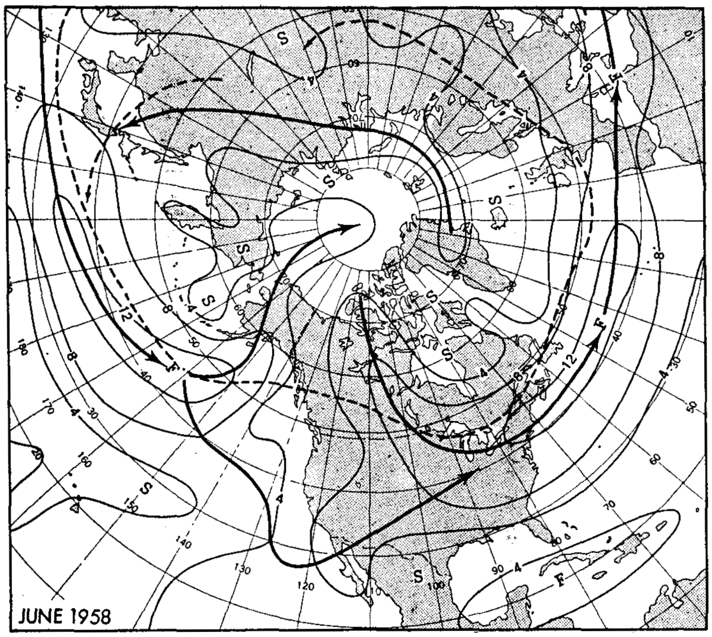


FIGURE 2.—Average 700-mb. wind speeds (meters per second) for June 1958. Solid arrows are axes of maximum speed (jets). Dashed line shows principal jet in May 1958. Major feature is confluence near lower Great Lakes.

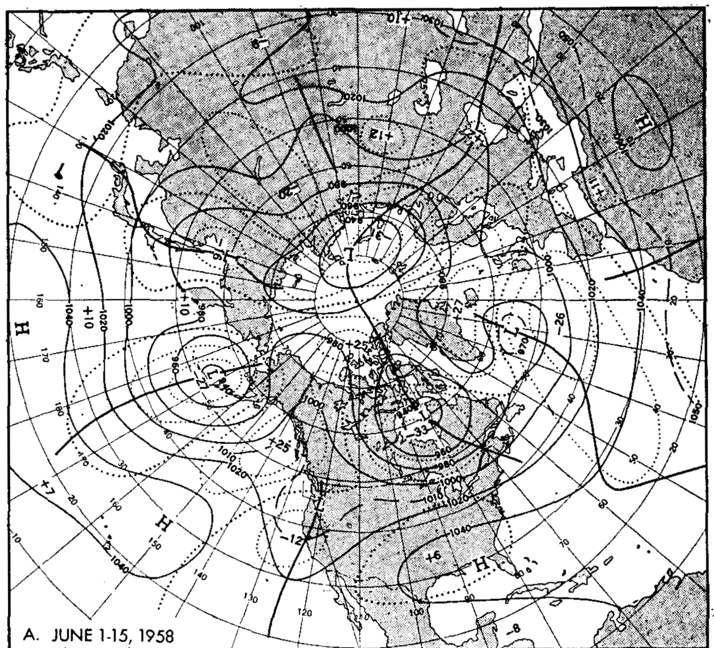
3A with figure 1, since a rather marked change occurred in the second half of the month. The strongly confluent pattern which characterized the circulation during the first 15 days of June made a strong contribution to the severe weather which occurred in the Mississippi and Ohio Valleys during this time.

Figure 3 also shows the southward migration of the negative height anomaly from Hudson Bay in the first half of the month to the Great Lakes and St. Lawrence Valley in the second half. During the second half of the month marked filling of the Pacific coastal trough and change to a widespread northerly anomalous flow over the midsection of the country were responsible for flooding the country east of the Rockies with record-breaking cool air.

In the Gulf of Alaska the positive height departures shown in figure 3B were a manifestation of marked retrogression in the second half of the month. Five-day mean charts during this period (not shown) disclosed that the trough in mid-Pacific returned to the western Pacific where it had been early in May. For example, a strong positive height anomaly center was near the British Columbia coast along the 135th meridian on the 5-day mean chart of June 19–23, and a week later it was observed along the 155th meridian. This retrogression near month's end was important in redeveloping the western United States trough and spreading warm air eastward to end the cool wave in the central and eastern parts of the country, which dominated the last half of the month.

4. COMPARISON OF JUNE WITH THE SPRING MONTHS

Figure 4 is a mean of the 700-mb. circulation for the spring months of 1958, March, April, and May. The most striking anomaly of spring was the tremendous positive departure from normal height over eastern Canada. In fact, a general circumpolar area of positive anomaly existed, but centered near the magnetic pole rather than the geographic pole. This area was girdled to the south by a wide band of negative height anomalies and depressed westerlies around practically the entire hemisphere except the central Pacific. This band was associated with below normal spring temperatures over



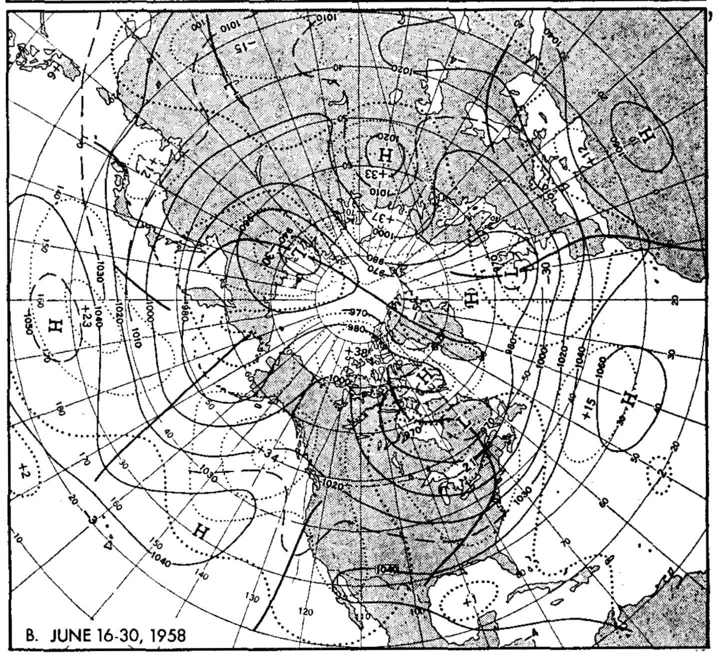


FIGURE 3.—Fifteen-day mean 700-mb. contours (solid) and departures from normal (dotted) (both in tens of feet) for (A) June 1–15, 1958 and (B) June 16–30, 1958. Deep Pacific coastal trough and marked confluence during the first half of June were followed by development of ridge in West and trough in East during the second half of the month.

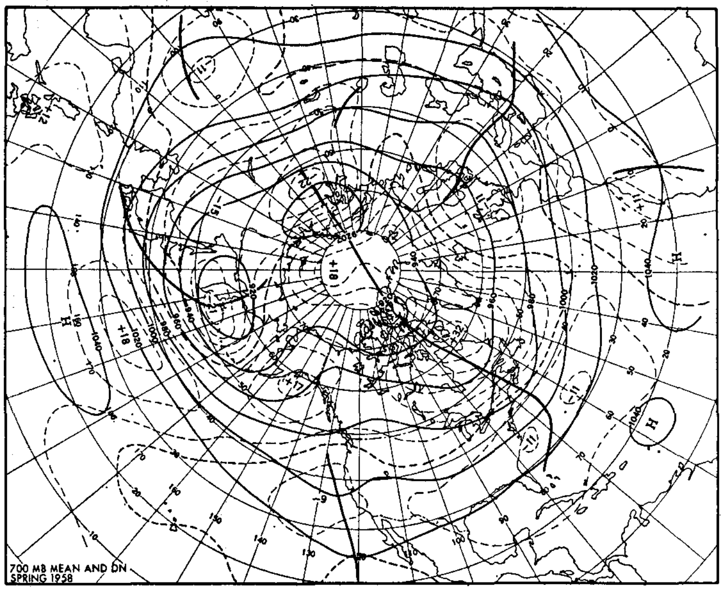


FIGURE 4.—Mean 700-mb. contours (solid) for spring (March, April, May) 1958. Principal features were above normal westerlies south of Kamchatka, blocking in Gulf of Alaska and Canada, and deeper than normal Pacific and Atlantic coastal troughs.

practically the entire United States south of about the latitude of Chicago, and abundant precipitation throughout the country except for the extreme north central sections, southern Michigan and northeastern Indiana, as well as extreme southeastern Texas. The Pacific coast trough during spring was deeper than normal, resulting in above normal precipitation over many sections of California.

Another striking feature of spring was the deeper than normal center of action near Kamchatka and the above normal subtropical High to the south of it, resulting in an average speed of the westerlies of about 10 knots above normal, a considerable departure for such a long average. This large abnormality of the westerlies was manifest downstream in persistent blocking over North America, perhaps in the manner suggested by Rex [4].

The major similarities and contrasts between June and the spring months can be determined by comparing the 700-mb. height departure from normal patterns in figure 1 with those in figure 4. By way of similarity the California coastal trough continued deeper than normal during June as it had been in spring and resulted in similar temperature anomaly patterns; i. e., above normal along the California coast and below normal in Nevada and interior California. The springtime above normal heights in the Gulf of Alaska were also strongly developed during June, together with much above normal temperatures in the Pacific Northwest States. A zone of above normal heights southeastward from this area was associated with above to much above normal temperatures in June over much of Utah, Colorado, Arizona, and New Mexico, where in spring it had been mostly below normal.

In eastern North America the strong springtime Canadian block centered near Hudson Strait retreated northwestward to the Arctic Ocean during June, leaving southeastern Canada and the eastern United States under the influence of below normal heights. Thus the springtime warmth relative to normal north of about 40° N. in North America gave way to below normal temperatures over most of the central and eastern United States (Chart I–A) and over a large part of Canada, except the western and northeastern areas, as can be inferred from the mean thickness departures from normal in figure 5.

The springtime negative height anomaly over the North Sea retrograded by June to a short distance southwest of Ireland, and below normal thicknesses prevailed from the British Isles northeastward across Scandinavia and eastward along the Arctic coast of the USSR.

5. CYCLONE AND ANTICYCLONE TRACKS

Cyclone tracks over North America, although appearing chaotic for the month as a whole (Chart X) have a more logical appearance when viewed in relation to the half-month circulations and their height anomalies (fig 3). In the first half-month, as pointed out earlier, a channel of negative height anomaly existed from California northeastward into the large negative anomaly center over Hudson Bay, together with a confluent jet pattern (fig 2). The cyclone tracks for the first half of the month were entirely compatible with this large-scale circulation, with cyclonic centers on about the 1st, 3d, 6th, and 9th emanating from the Rocky Mountain area in the southern branch of the split westerlies and proceeding northeastward across the Great Lakes, thence northward around the eastern periphery of the center of action over Hudson Bay. During this same period, additional cyclonic centers were propagated southeastward in the northern branch of the westerlies along the tracks clustered in the Great Bear Lake area of western Canada, also terminating in the Hudson Bay center of action. The track emanating from the western United States on about the 9th was considerably farther north than previous tracks, perhaps suggesting a tendency for a change in the circulation. On the 13th and 14th the strongest cyclonic development of the month occurred in southeastern Canada, and lingered over this area for almost a week. This marked the beginning of the major change in the general circulation over North America which was to dominate the latter half of the month. The confluence over northern United States, which had favored systems moving northeastward from the Plateau in the first half of the month, receded southward and ended this storm track until near the month's end.

The circulation during the second half of the month (fig. 3B) was characterized by an abnormally strong trough system in the East, together with an abnormally strong ridge in the West. With above normal northwesterly flow keeping the eastern United States flooded with cold air, a new storm path more characteristic of the colder seasons developed. This path is indicated by the cluster of tracks shown in Chart X along the middle Atlantic coast, extending eastward across the Atlantic in the mean sea level trough (Chart XI).

The tracks of anticyclones over North America for the month as a whole (Chart IX), although emanating from a rather narrow zone near Great Slave Lake in northwestern Canada, became widely dispersed as they turned eastward over central North America, ranging from a path across James Bay in the first part of the month, to a path across Arkansas in the latter part of the month.

No clear-cut track of maritime polar anticyclones occurred this month from the northern Rockies toward the Great Lakes Region, an area ordinarily traversed by a "principal" track of Highs during June [5]. When the tracks for the whole month were divided into half-monthly groups, the northernmost tracks across the Great Lakes region were found to occur in the first half of the month when the westerlies were closer to their normal position. During this period the actual tracks were in closer agreement with the "principal" tracks [5].

However, the anticyclone tracks which characterized the second half of the month were the southernmost ones which dipped southward into Kansas, Arkansas, Kentucky, etc. These tracks, which were well south of the "principal" track for June, were associated with the abnormally deep mean trough in the eastern United States in the second half of the month. Record-breaking cool temperatures occurred over many sections as strong northerly flow over central sections deployed successive polar anticyclones farther and farther south during this period. Actually the anticyclone tracks in the second half of June were more characteristic of late winter or early spring [5] than of early summer.

6. CHRONOLOGY OF SURFACE WEATHER SYSTEMS

The first storm of the month emerged from Utah into the Northern Plains on the 4th with heavy rains and local flooding in southeastern Minnesota and northwestern Wisconsin. Severe tornadoes in Wisconsin killed at least 28 persons, with hundreds injured and homeless and property losses tremendous.

This storm was followed by a polar anticyclone from Manitoba which moved into the Northern Plains on the 5th, thence rapidly eastward across southern New England on the 7th, with record low temperatures and frosts in parts of Michigan, Pennsylvania, New York, and New England. Norfolk, Va. reported a new record for minimum temperature on the 8th.

On the 6th and 7th another cyclonic system emerged from Idaho to the Dakotas and merged over the Great Lakes with a cold front sweeping southeastward from Canada on the 8th. The marked confluence aloft caused this front to strengthen and become stationary across Ohio, Indiana, and Illinois, while still another Low emerged from the Plateau into the Central Plains on the 9th and 10th producing an abnormally strong low-level southerly flow of extremely moist tropical air against the stationary front. This resulted in flood-producing rains over north central Indiana, and locally severe thunderstorms and tornadoes in a zone from Kansas to the east coast on the 10th. At least 15 died from a tornado at El Dorado, Kans. on the 10th, which also caused millions of dollars damage.

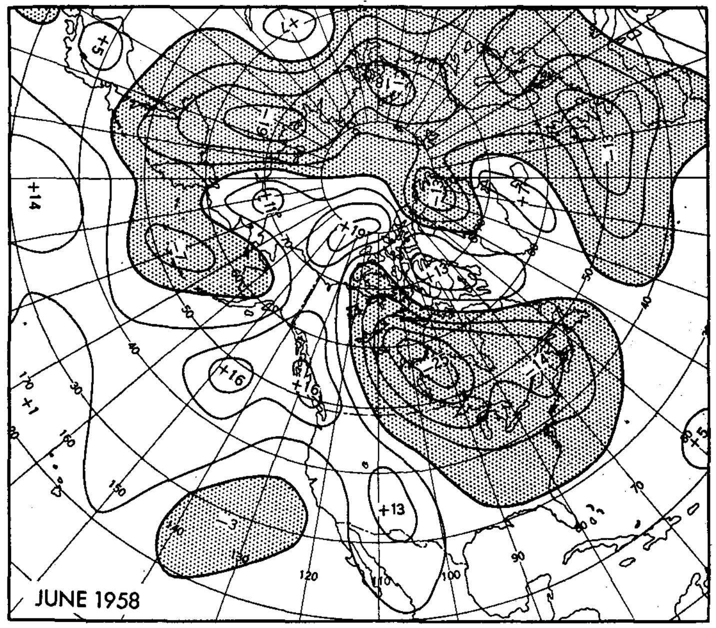


FIGURE 5.—Mean departures from normal of 1000–700-mb. thicknesses for June 1958 (tens of feet). Outstanding feature was below normal thickness (shaded) over large part of North America.

On the 11th the front started moving eastward from the Mississippi Valley to the mid-Atlantic coast, accompanied by heavy showers and squalls, with Philadelphia, Pa. reporting 73 m. p. h., a new record there for the fastest mile of wind, and Washington County, Md., reporting winds up to 100 m. p. h.

A polar anticyclone which moved across the Great Lakes from Alberta on the 11th and 12th set new minimum temperature records in parts of Wisconsin, Minnesota, and Pennsylvania, and provided a respite from the flooding rains in the Wabash Basin of Indiana.

On the 12th and 13th another cyclonic center emerged from the Plateau into the Central Plains, tending to merge with a deepening Low moving southeastward across James Bay, similar to the situation on the 8th. Heavy rains spread rapidly across the country in the strong confluent jet flow aloft across northern sections of the country, being particularly heavy in the central Mississippi and Ohio Valleys. The earlier flood conditions in Indiana were aggravated, and damaging thunderstorm activity occurred in the Ohio Valley on the 13th.

On the 14th, under the influence of very strong deepening of the merged cyclonic centers near the Gulf of St. Lawrence, a strong anticyclone pushed slowly southward across the North Central States, preceded by a strong cold front and prefrontal squall line moving across the mid-Atlantic States. This front continued slowly southward to near the Gulf coast during the next four days under the influence of the major trough aloft in the East and ridge in the West which developed strongly during this period. This major change in the general circulation from the first half of the month was associated with the strong cyclonic development over the Maritime Provinces and ridging in the Gulf of Alaska. The southward-moving cold front was preceded by record maximum temperatures in many parts of the Southeast on the 13th and 14th, damaging thunderstorm activity in the East and Southeast, and abnormally heavy rains throughout most of the Gulf area. In the cold air north of the front damaging frosts occurred in northern Michigan and new record low temperatures were prevalent in parts of the Northeast.

During this period the first tropical storm of the season, Alma, with winds of about 50 knots, formed on June 14, about 150 miles east of Tampico, Mexico, in the western Gulf of Mexico. Alma reached the coast early on the 15th about 75 miles south of Brownsville, Tex., losing its identity rapidly as it moved up the Rio Grande Valley on the 16th. Little damage occurred from winds and tides, but torrential rains in the hill country west of San Antonio, Tex., in excess of 7 inches, and with some measurements as high as 20 inches, produced locally heavy flood damage.

Under the influence of the persistent broad trough in the East and northerly flow over central sections aloft emanating from the strong ridge over the western Plateau, another surge of polar air associated with a surface anticyclone made its way southeastward from Alberta on the 19th across Missouri to the east coast on the 23d. Heavy to torrential rains in some places in the Southern Plains, lower Mississippi Valley, and Gulf coastal areas accompanied the southward progress of the leading edge of the cold air. New record low temperatures were reported in many places during this period over a wide area embracing Montana, Nebraska, Minnesota, Wisconsin, Ohio, and Pennsylvania, with damaging freezes in parts of Wisconsin and Michigan. In contrast, record high temperatures were occurring in the Pacific Northwest, with Pendleton, Oreg., reporting 103° F. and Yakima, Wash., 102° F. on the 22d.

On the 24th a fresh outbreak of cold air from Alberta and Saskatchewan began protruding southward into the north central sections of the country, associated with a rapidly developing storm over the Great Lakes on the 25th and 26th. During the period from the 24th to the 29th, the most southerly trajectory of any polar anticyclone during the month occurred, producing record low temperatures on as many as four successive days in some places in the Southern Plains and generally much below to record low temperatures over most of the United States east of the Rockies. As the leading edge of this cool wave swept eastward to the coast on the 26th and 27th, heavy showers were general throughout much of the eastern United States and damaging thunderstorms were widespread, especially up and down the east coast. Rochester, N. Y. Airport recorded gusts to 103 m. p. h. on the evening of the 25th with widespread damage in part of the city. By way of contrast, in the western Plateau, Salt Lake City reported a record high of 102° F. on the 27th. A detailed study of this unusually cold outbreak from June 24–27 by Jordan and Lowry [6] can be found in an adjoining article in this issue.

The remainder of the month was relatively dry as the polar anticyclone in the East became transformed into a warm extension of the Bermuda High, and a strong warm ridge in the westerlies aloft replaced the large trough which had dominated the East since mid-month. This major change in the circulation was accompanied by marked cooling in the West as a strong maritime cold front in a major trough aloft moved eastward across the Rockies, associated with a new series of storms moving into the northern Plains and upper Mississippi Valley.

7. TEMPERATURE

The southward migration of the maximum westerlies from the May position was accompanied by general cooling relative to normal over most of the country, with the greatest cooling in the North Central States. The only stations reporting warmer temperatures than the previous month, relative to normal, were in Texas. The Pacific Northwest and the Colorado, Utah, Arizona, and New Mexico area remained well above normal.

Many cities from the upper Mississippi Valley eastward reported the coldest June of record; e. g., Green Bay, Wis., Youngstown, Ohio, Pittsburgh, Pa., Albany, N. Y., Newark, N. J., Hartford, Conn., and Providence, R. I. Second coldest June of record was reported by Escanaba, Mich., Indianapolis, Ind., Akron, Ohio, Portland, Maine, and Burlington, Vt.; the third coldest June, at St. Cloud, Minn., Rochester, N. Y., and Richmond, Va.

By way of contrast, this June was the warmest on record at many places in the Pacific Northwest such as Olympia and Seattle, Wash., and Meacham, Oreg., while Pendleton, Oreg., equalled the June record for warmth. Second warmest of record was reported by San Francisco and Los Angeles, Calif., and Houston, Tex.

The mean 1000–700-mb. thickness anomalies given in figure 5 summarize the large-scale departures from normal of the low-level thermal field. Comparing figure 5 with Chart I–A shows the correspondence between average thickness departures and reported monthly temperature anomalies. In the Northeast, for example, average thicknesses 50 ft. or more below normal were associated with much below normal average monthly surface temperatures, and in the West thicknesses roughly 100 ft. or more above normal were associated with much above normal surface temperatures.

A map of the number of days with fronts for a network of squares covering North America (not shown) revealed that the mean position of the polar front in June was in close agreement with the zero average thickness departure line in figure 5, running from Alberta southward to the Texas Panhandle and eastward through the Gulf States to the Carolinas. This was certainly an abnormally depressed location for the mean polar front near the beginning of summer.

In local areas the correspondence between mean thickness and surface temperature anomalies occasionally may be poor, even in as long an average as a month. For example, tongues of slightly above and below normal average surface temperatures alternated across the Gulf States where the monthly thickness departures appeared to be uniform. These variations are probably due in part to the variations in precipitation; e. g., along the southern Appalachians below normal precipitation favored warmer surface temperature.

Perhaps the most interesting temperature anomaly pattern in Chart I–A is the below normal area in Nevada and interior California, while the coastal area of California reported much above normal, this being the second or third warmest June on record along the coast. A similar contrast also appeared in the spring anomalies, although May was above normal in the interior as well as along the coast. The deeper than normal California coastal trough in June (fig. 1) as well as in spring (fig. 4) resulted in California and Nevada being persistently under the influence of cooler than normal maritime polar air. At Fresno, Calif., an interior station, while the daily mean temperatures averaged about 3° below normal for June, the maximum temperatures averaged about 5° below normal. With near normal sunshine and sky cover, the cool air aloft kept the lapse rates steep, thus keeping the maximum temperatures considerably below normal.

Across the mountains on the coast however, San Francisco City Office and Los Angeles Airport reported this June was the second warmest on record. This occurred despite their exposure to about the same gross synoptic conditions aloft as in the interior where temperatures were below normal.

Normally, cool conditions in the interior are associated with diminished onshore winds along the coast, thus reducing the cooling effect of the sea breeze, but this could not be the explanation of the above normal conditions on the coast in this case, for the San Francisco City Office average surface winds were about one mile per hour above normal. Also on 20 days when the westerly winds averaged above normal, the daily mean temperatures averaged about 3° above normal. Likewise, Los Angeles Airport reported winds above normal on almost every day, together with above normal temperatures on every day during the month.

As far as sky cover was concerned, San Francisco averaged above normal sky cover from sunrise to sunset, resulting in the greater contribution to the monthly positive anomaly by the minimum temperatures. At Los Angeles, the daytime sky cover averaged considerably below normal with the greater contribution to the anomaly by the maximum temperatures. Thus contributions were made by both daytime and nighttime temperatures, the greater effect depending on the sky cover.

These facts suggest that abnormal sea-surface temperatures played a dominant role in the much above normal temperatures reported along the coast during June. That this was probable may be seen by referring to charts of anomalies of sea-surface temperatures off the California coast for the period June 11–20 [7]. These charts showed a large area of ocean surface off the coast with temperatures ranging up to 8° F. above normal during the period. On the other hand, in the interior, the abnormally warm sea surface had little effect upon surface temperatures because interior sections are separated from the influence of ocean temperatures by the coastal mountain range.

8. PRECIPITATION

Turning to the monthly precipitation pattern, it can be seen in Chart II–B that one of the major areas of above normal precipitation extended from northern California, Oregon, and northwestern Nevada through Idaho and southern Nevada into the Plains. This heavy precipitation area was produced by the vertical motion fields accompanying the numerous vorticity maxima which propagated from the deeper than normal coastal trough in the well-developed current of moist southwesterlies over this area, especially in the first part of the month. Many stations such as Winnemucca, Nev., Boise, Idaho, Missoula, Mont., and Red Bluff, Calif., reported the wettest or near wettest June of record. Boise received 2.24 inches of rain in one 24-hour period on the 11th and 12th, a new record for 24-hour rainfall in June.

Another major area of precipitation was the middle Mississippi and Ohio Valleys. Some stations in this area reported the wettest or near wettest June on record, such as Fort Wayne, Ind., with 8.29 inches, and Columbus, Ohio with 9.75 inches, the greatest June amount and second largest ever recorded there in one month. The major contribution to the heavy amounts in this area was the marked confluence during the first half of the month, and particularly during the second week, as the cyclonic systems of about the 8th and 13th dumped flooding rains over some sections, particularly the Wabash Basin.

During about the 3d week of the month, due to the major change in circulation aloft near mid-month (i. e., trough development in the East and ridge development in the West) the confluence zone shifted southward to the Southern Plains and lower Mississippi Valley, associated with a strong frontal zone across southern portions of the country east of the Rockies. This change shifted the heavy precipitation areas southward, resulting in weekly totals up to 20 inches west of San Antonio, Tex. (due to tropical storm Alma), 4 inches in parts of Oklahoma and southern Kansas, 5 inches in Arkansas, and 6 inches in interior Louisiana. Jackson, Miss. reported the 6th wettest June on record with 8.77 inches, only 0.58 inch below the record amount in June 1900. About 7.37 inches of this amount occurred during the 3d week.

Most of the rainfall during the last week occurred as moist tropical air was lifted along the strong cold front which moved across the country in advance of the major cool wave which overspread the East in the latter part of the month.

Areas of lighter or below normal precipitation were the

Appalachian region which was generally west of the mean trough, the upper Mississippi Valley and extreme northern border areas westward to the Pacific coast which were persistently under the influence of northerly flow, the Central Plains which was somewhat south of the northern confluence zone and also to some extent in a "rain shadow" or zone of dessication of the Pacific moist tongue east of the Rockies. Another dry area extended from the extreme Southwest northeastward into Utah, due to the prevalence of anticyclonic vorticity east of the Pacific coastal trough. Extreme southern Texas was also dry under strong anticyclonic vorticity aloft just south of the southern confluence zone.

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Weather Note

WORLD RECORD LOW TEMPERATURE

A report of a new low temperature record for the world* was received from Mr. Morton J. Rubin, U. S. Weather Bureau meteorologist stationed with the Soviet IGY Antarctic expedition at Mirny, Antarctica. Three successive records were set: at Vostok (78°27′ S., 106°52′ E., elevation approximately 3500 meters) on June 15, −113.3° F. (−80.7° C.) was recorded; at Sovetskaya (78°24′ S., 87°35′ E., elevation approximately 3700 meters) on June 19 the temperature fell to −113.8° F. (−81.0° C.), and on June 25 to −117.4° F. (−83.0° C.). The new record at Sovetskaya is "taken from corrected weekly thermograph trace with 3-hourly comparisons during periods of extreme temperatures." The following further information regarding the conditions under which these temperatures occurred is taken from Mr. Rubin's dispatches.

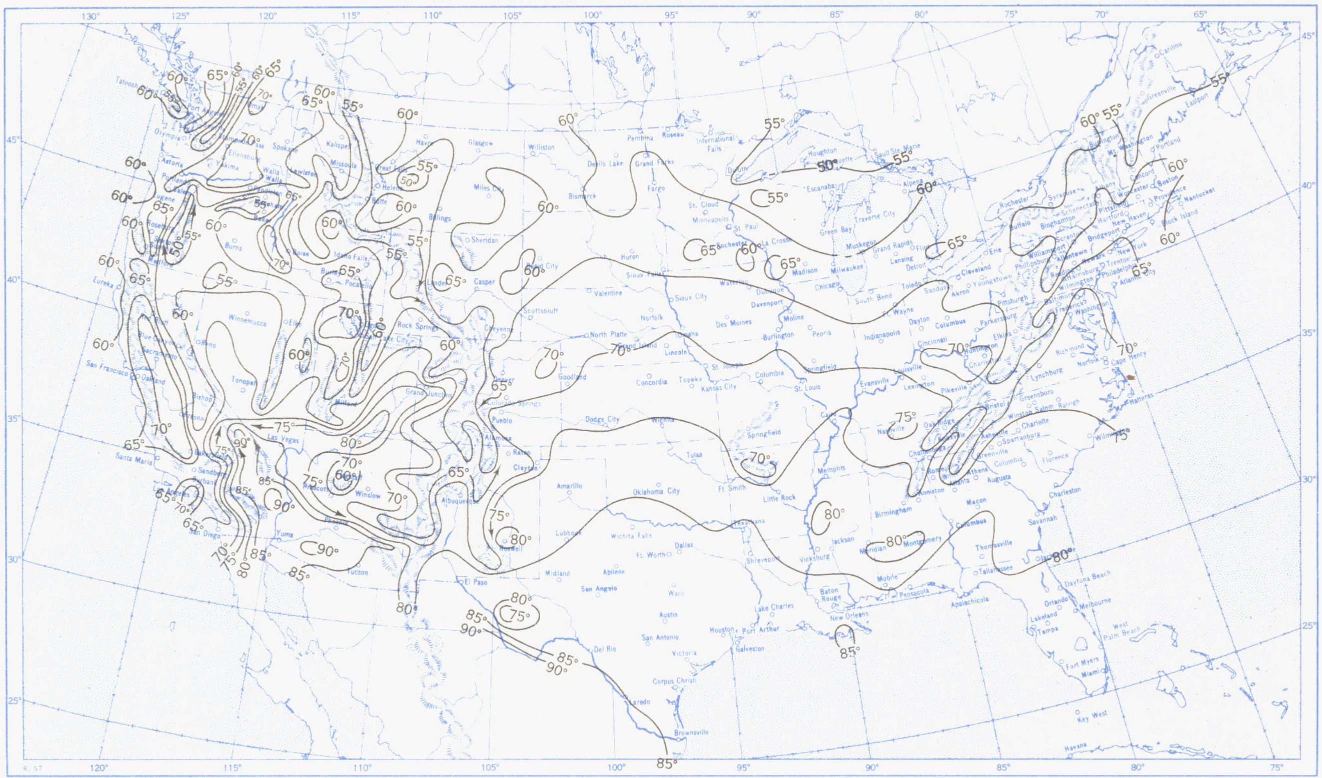
June 15 Vostok reading of −80.7° C.: From 0000 GMT, June 14 the temperature at Vostok fell from −69° C., with a surface wind from the southwest at 6 to 4 kt. and partly cloudy skies with altocumulus, to −78° C. with west wind at 2 kt. and clear skies at 1200 GMT on June 15. By 1800 GMT on June 15 the temperature had fallen to −79° C. with northwest wind of 2 to 4 kt. and clear skies. The minimum (−80.7° C.) was recorded between 1800 GMT, June 15 and 0000 GMT, June 16. During the same period at Komsomolskaya (74°08′ S., 97°17′ E., elevation approximately 3200 meters) temperatures dropped to −70° to −72° C. with southerly surface winds at 6–8 kt. and clear skies. At Sovetskaya temperatures fell from −67° to −75° C. with northeast winds at 8 kt. and clear skies. There was a 500-mb. col in the region of 80° S., 95° E. with generally weak westerly flow. At 300 mb. a Low was located near 80° S., 120° E. with a col stretching from 80° S. southeastward to 80.8° S., and weak west-southwesterly flow.

June 19 Sovetskaya low of −81.0° C.: At Sovetskaya the temperature fell from −69° C. at 0000 GMT, June 18 to −81° C. at 0000 GMT, June 19, with variable surface winds, northeast to east, at 8–10 kt. and clear skies during the entire period. Komsomolskaya's temperature dropped from −63° to −72° C. with east-southeast to south winds dropping from 8 to 4 kt. and partly cloudy conditions becoming clear at the end of the period. At Vostok the temperature rose from −79° to −74° C. while the wind changed from northwest at 8 kt. to west at 6 kt. with clear skies. Conditions at 500 and 300 mb. were approximately the same, with a ridge along 70° E. and a trough along 120° E. with marked south-southwest flow.

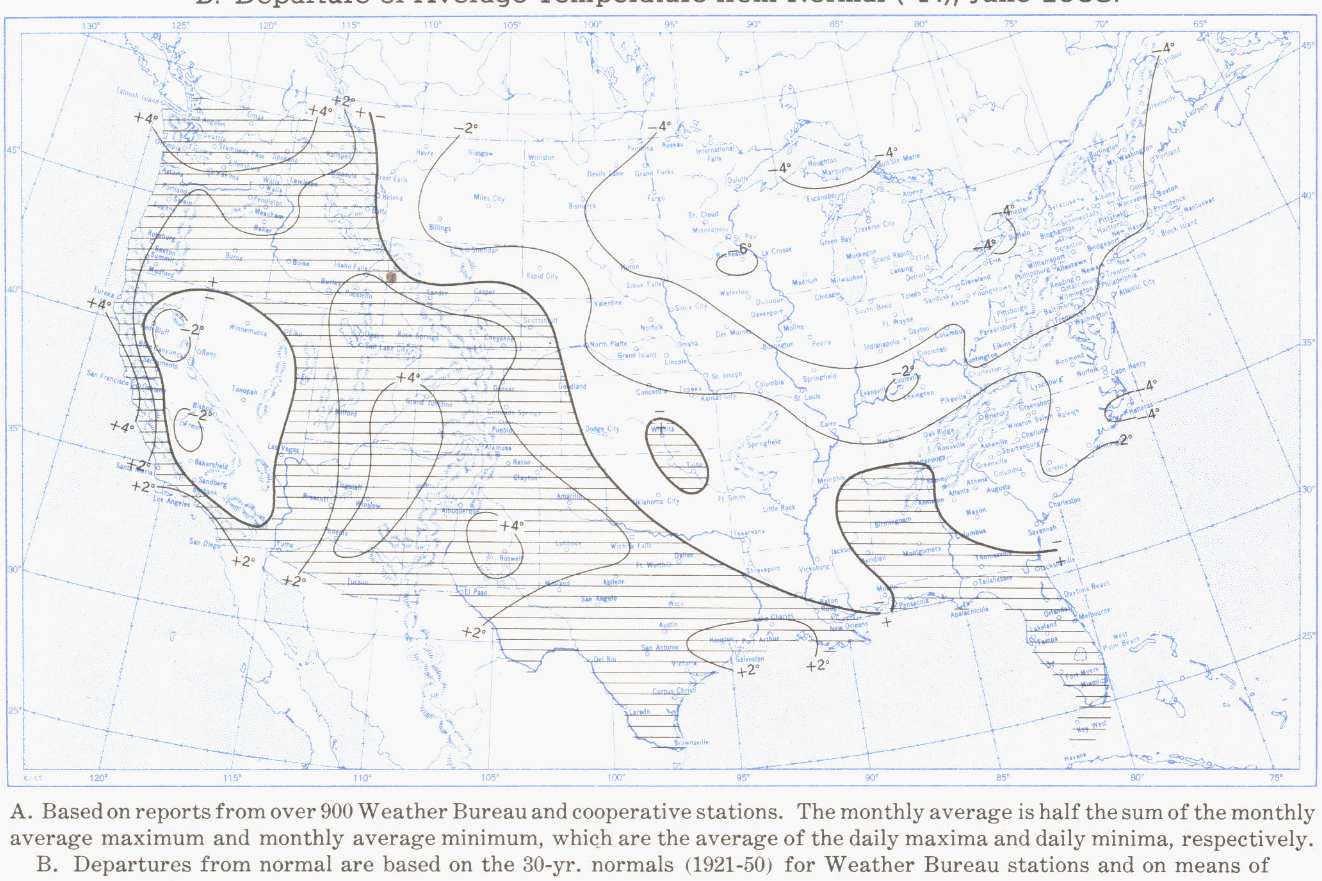
June 25 Sovetskaya low of −83.0° C.: Beginning at 0000 GMT, June 25 temperature at Sovetskaya fell from −72° to −80° C. at 0000 GMT, June 26; a surface wind from the east dropped from 12 kt. to 8 kt. under clear skies. The minimum temperature (−83.0° C.) was recorded at approximately 2200 GMT, June 25. At Komsomolskaya at the same time under clear skies the temperature dropped from −66° to −68° C., with a wind from the south-southeast changing from 12 to 10 kt. Vostok's temperature fell from −73° to −75° C. The wind there changed from southwest at 8 kt. to west at 4 kt.; skies were partly cloudy with altocumulus.

*See *Monthly Weather Review*, vol. 85, No. 11, Nov. 1957, p. 383, for the previous record low also recently reported from Antarctica.

Chart I. A. Average Temperature (°F.) at Surface, June 1958.

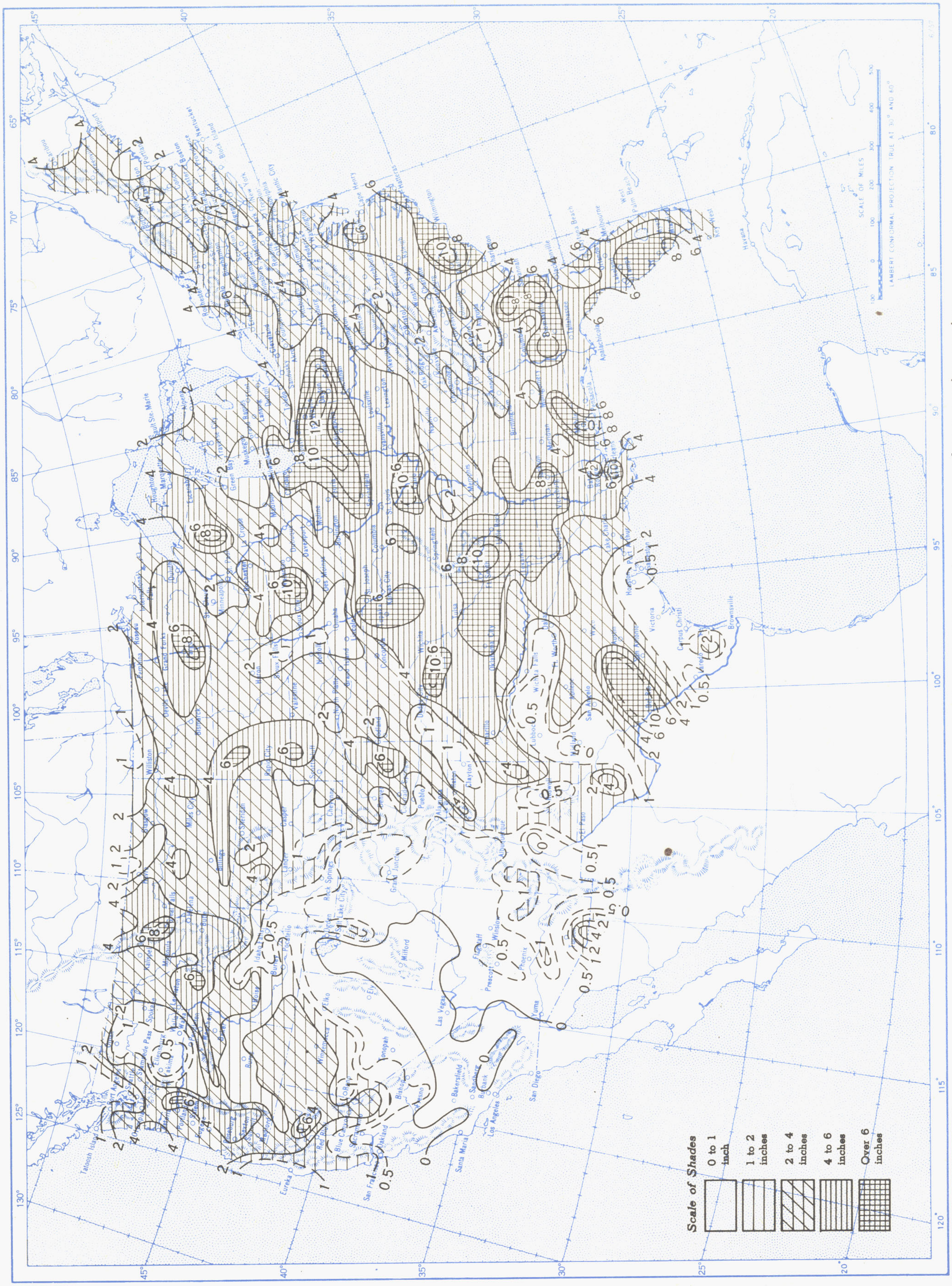


B. Departure of Average Temperature from Normal (°F.), June 1958.



A. Based on reports from over 900 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.
B. Departures from normal are based on the 30-yr. normals (1921-50) for Weather Bureau stations and on means of 25 years or more (mostly 1931-55) for cooperative stations.

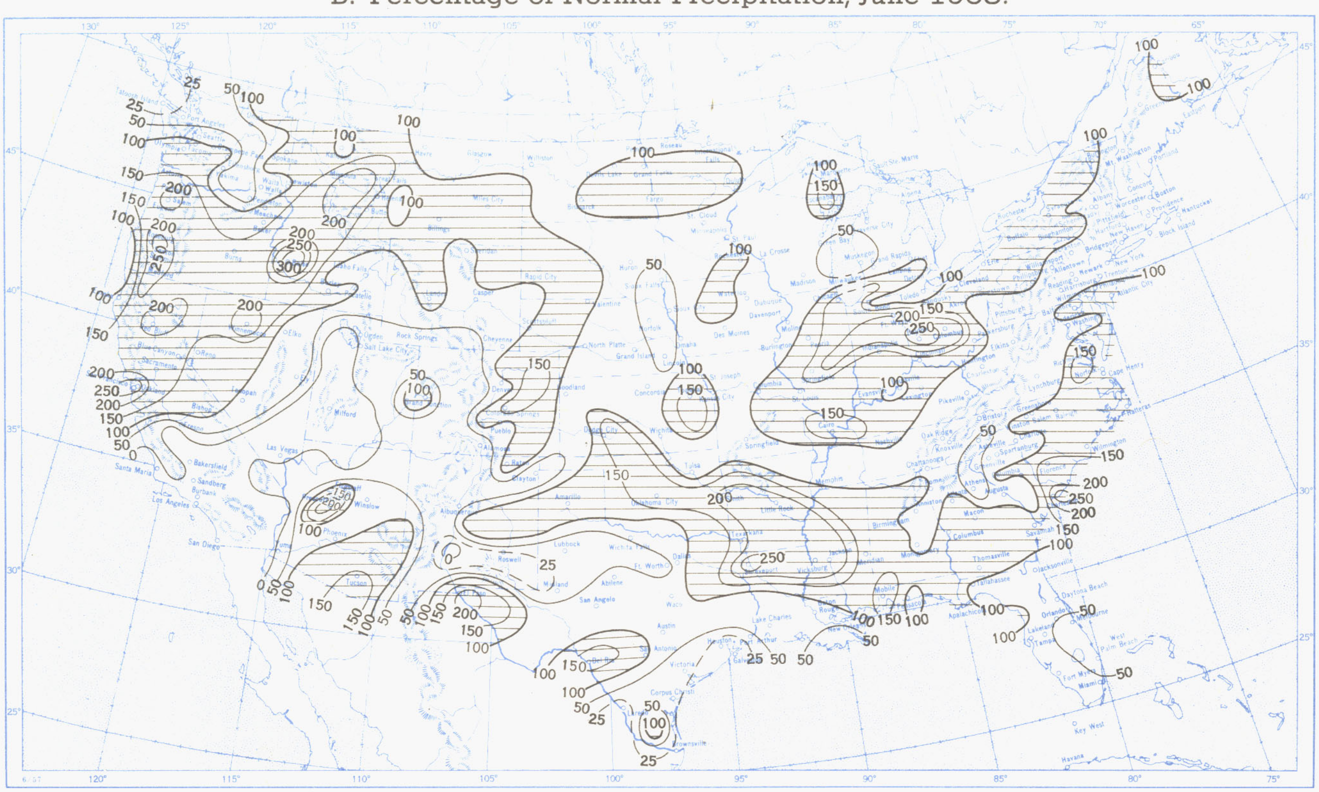
Chart II. Total Precipitation (Inches), June 1958.



Based on daily precipitation records at about 800 Weather Bureau and cooperative stations.

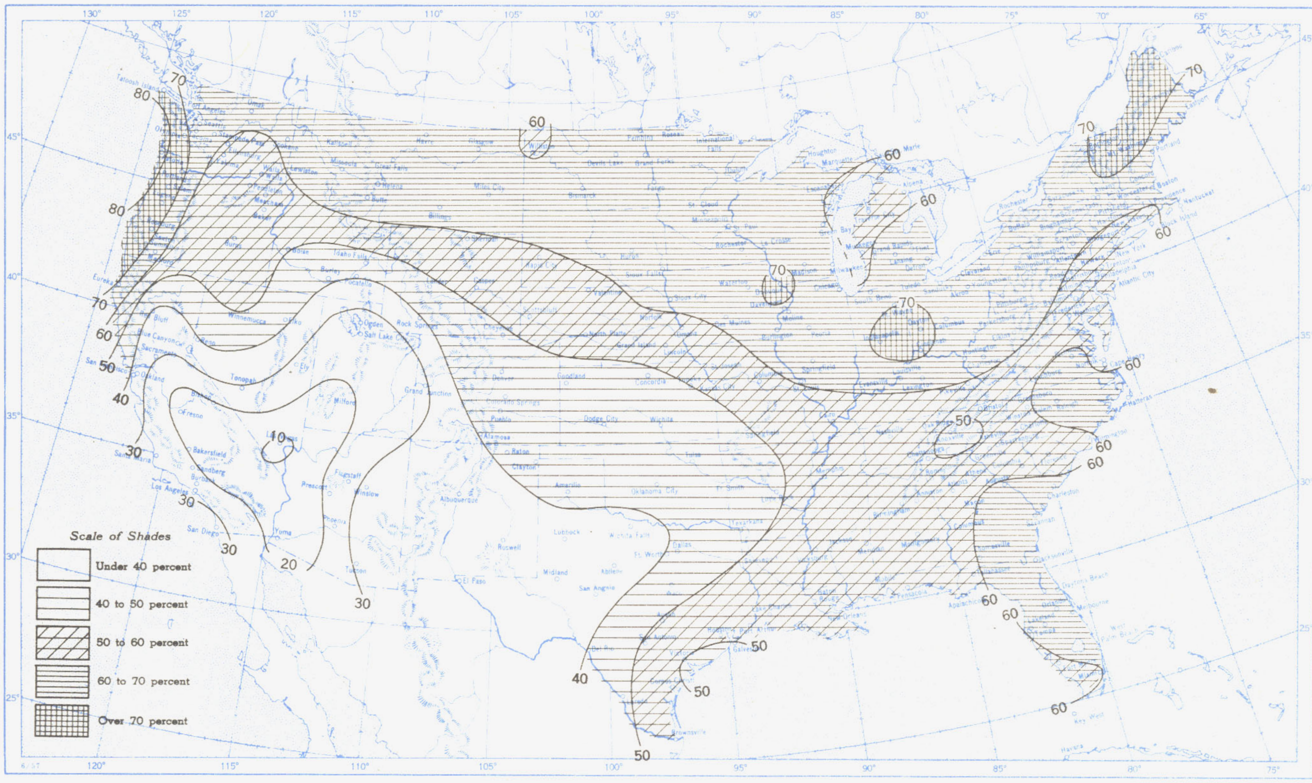
Chart III. A. Departure of Precipitation from Normal (Inches), June 1958.

B. Percentage of Normal Precipitation, June 1958.

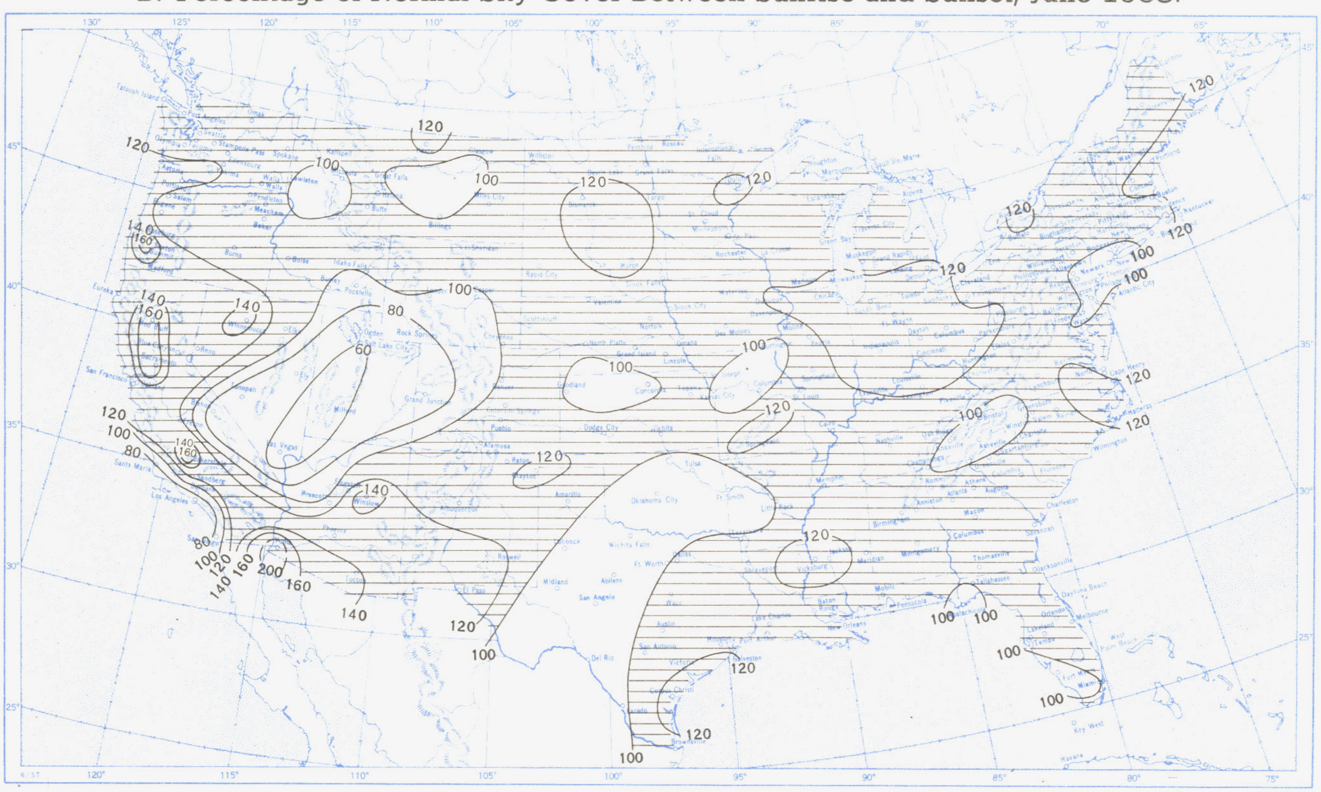


Normal monthly precipitation amounts are computed from the records for 1921-50 for Weather Bureau stations and from records of 25 years or more (mostly 1931-55) for cooperative stations.

Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, June 1958.

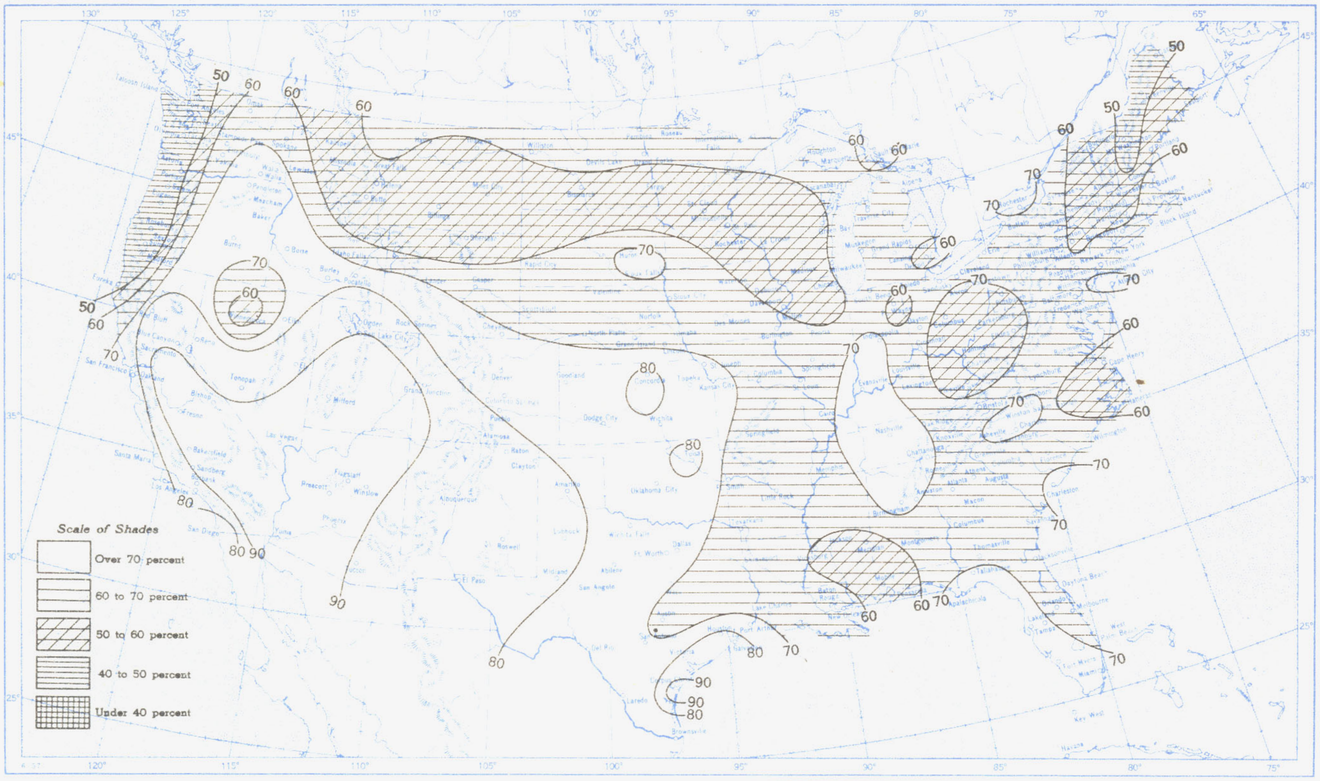


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, June 1958.

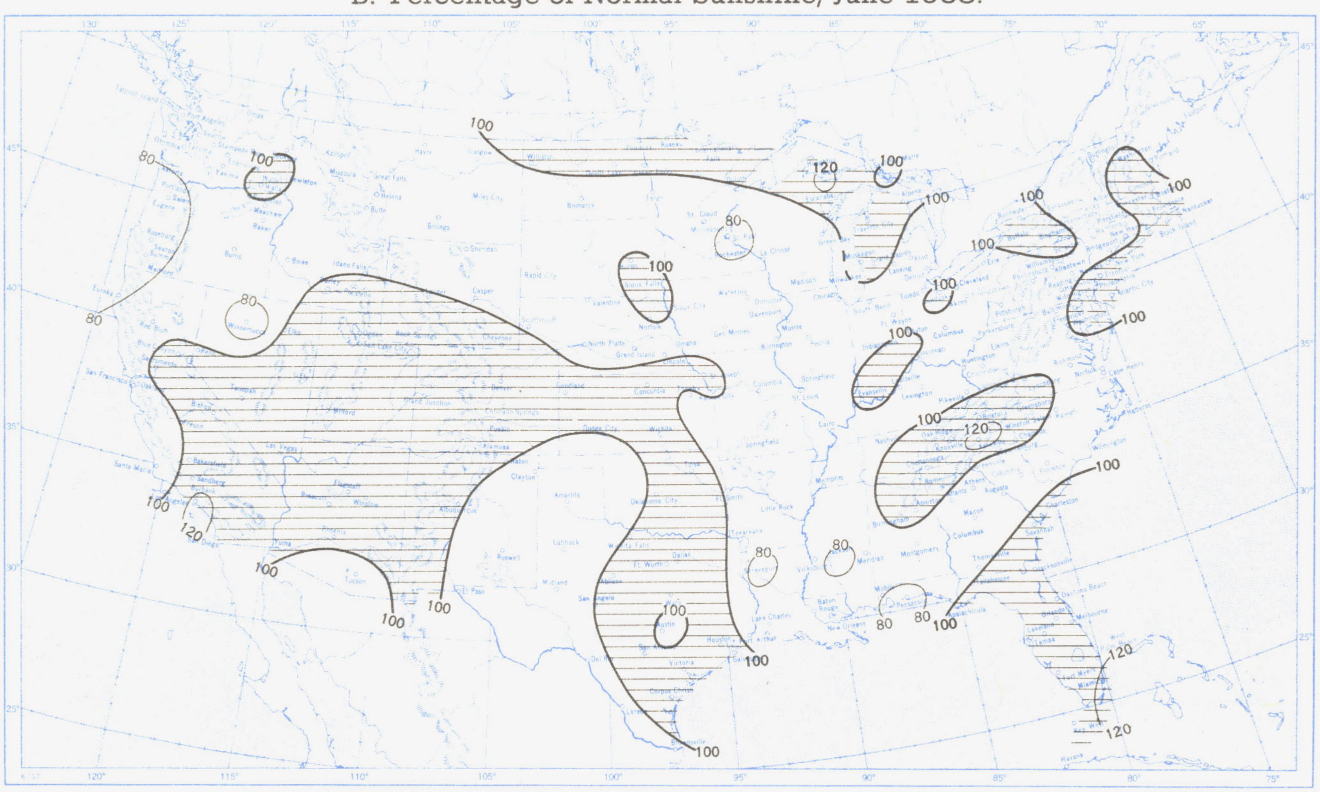


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, June 1958.



B. Percentage of Normal Sunshine, June 1958.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, June 1958. Inset: Percentage of Mean Daily Solar Radiation, June 1958. (Mean based on period 1951-55.)

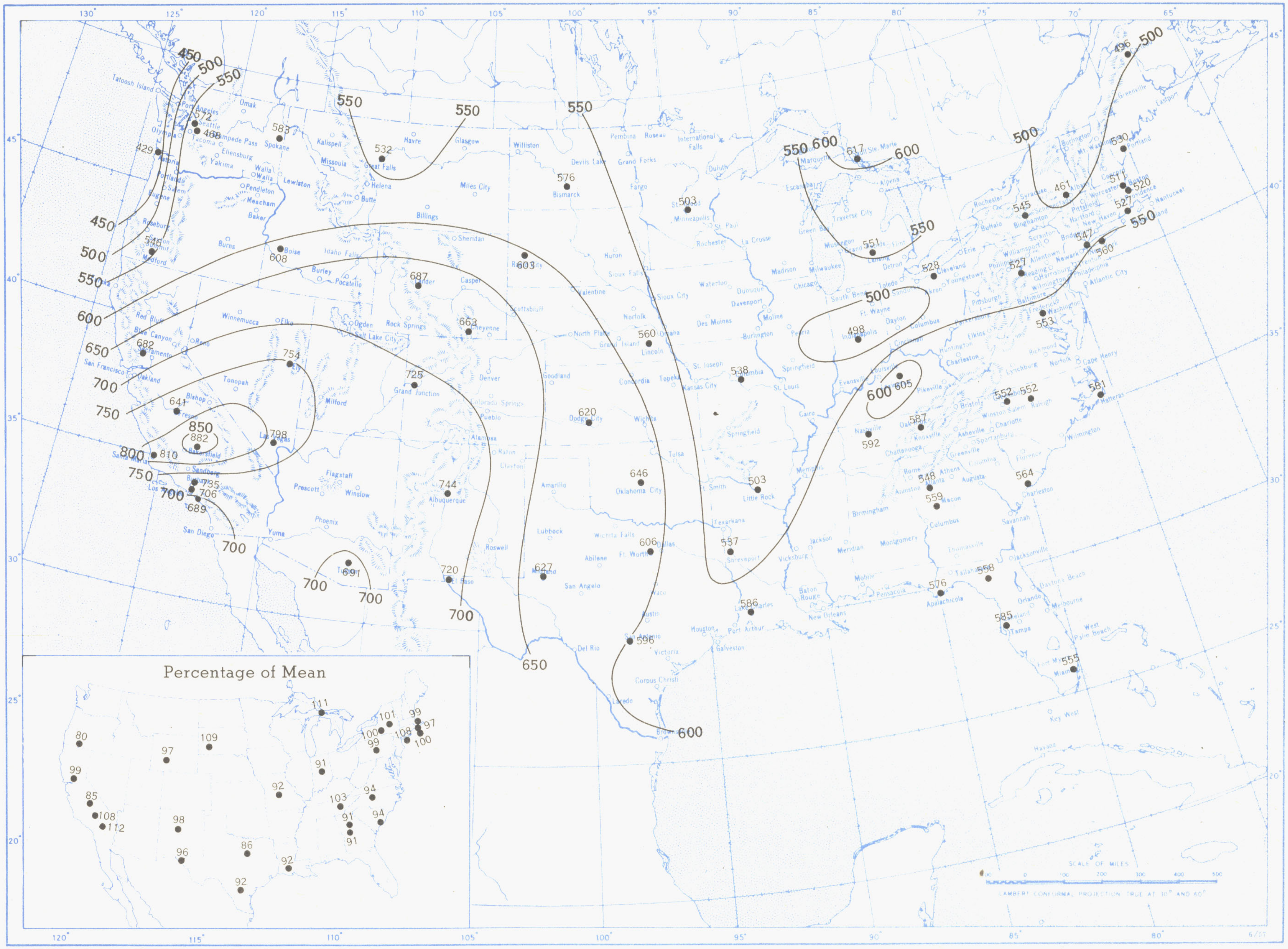
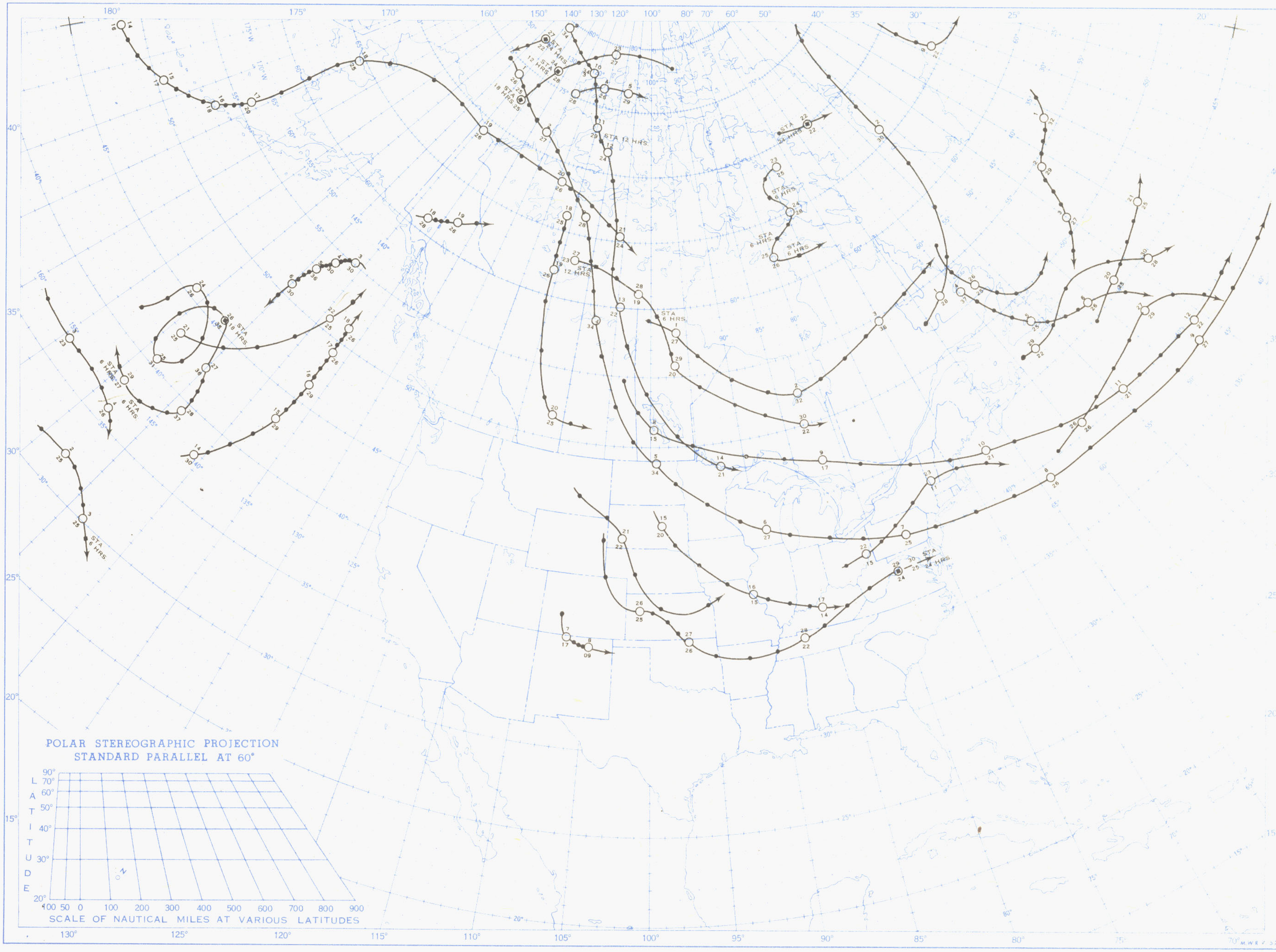


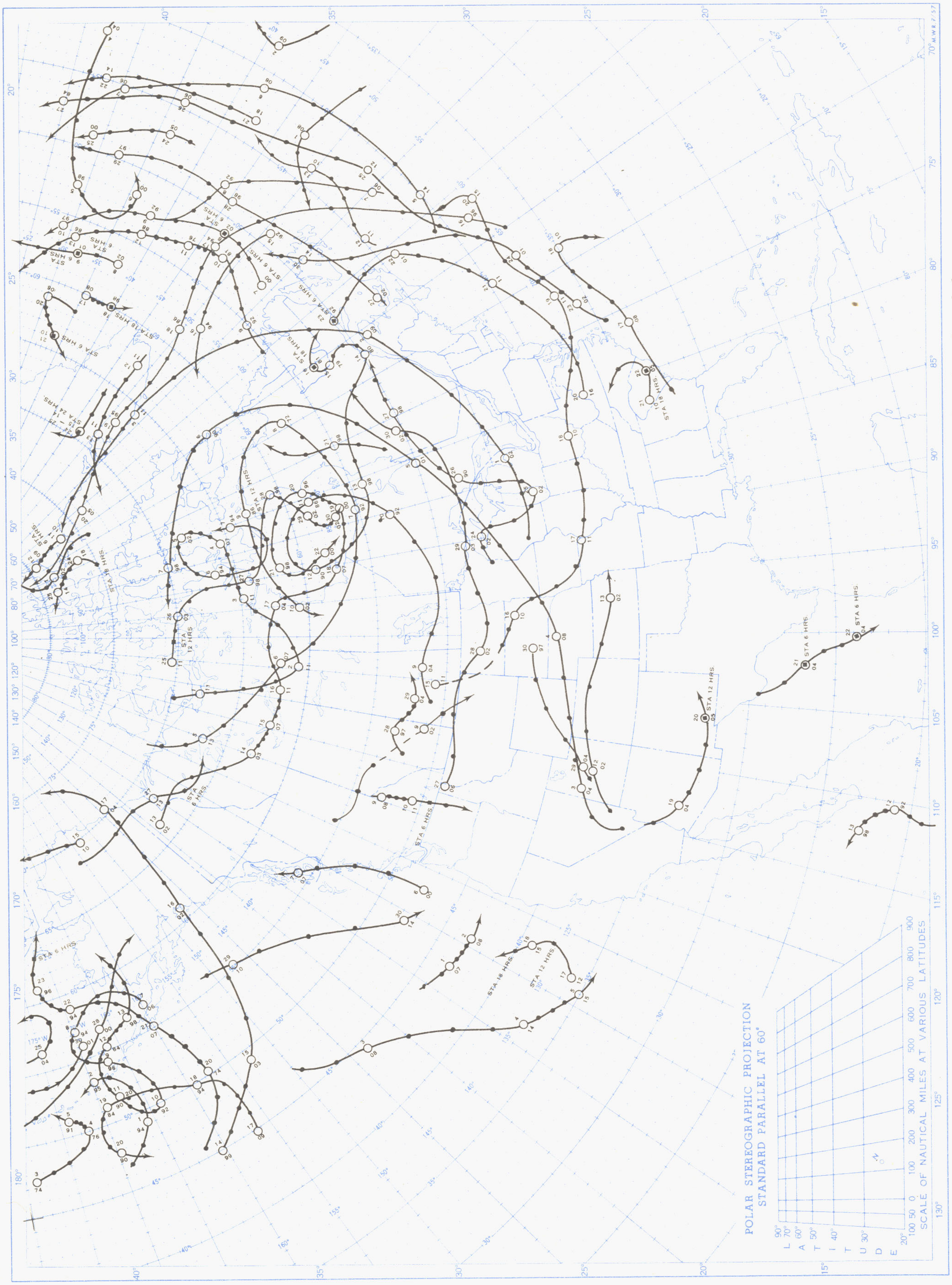
Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm. $^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown. The inset shows the percentage of the mean based on the period 1951-55.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, June 1958.



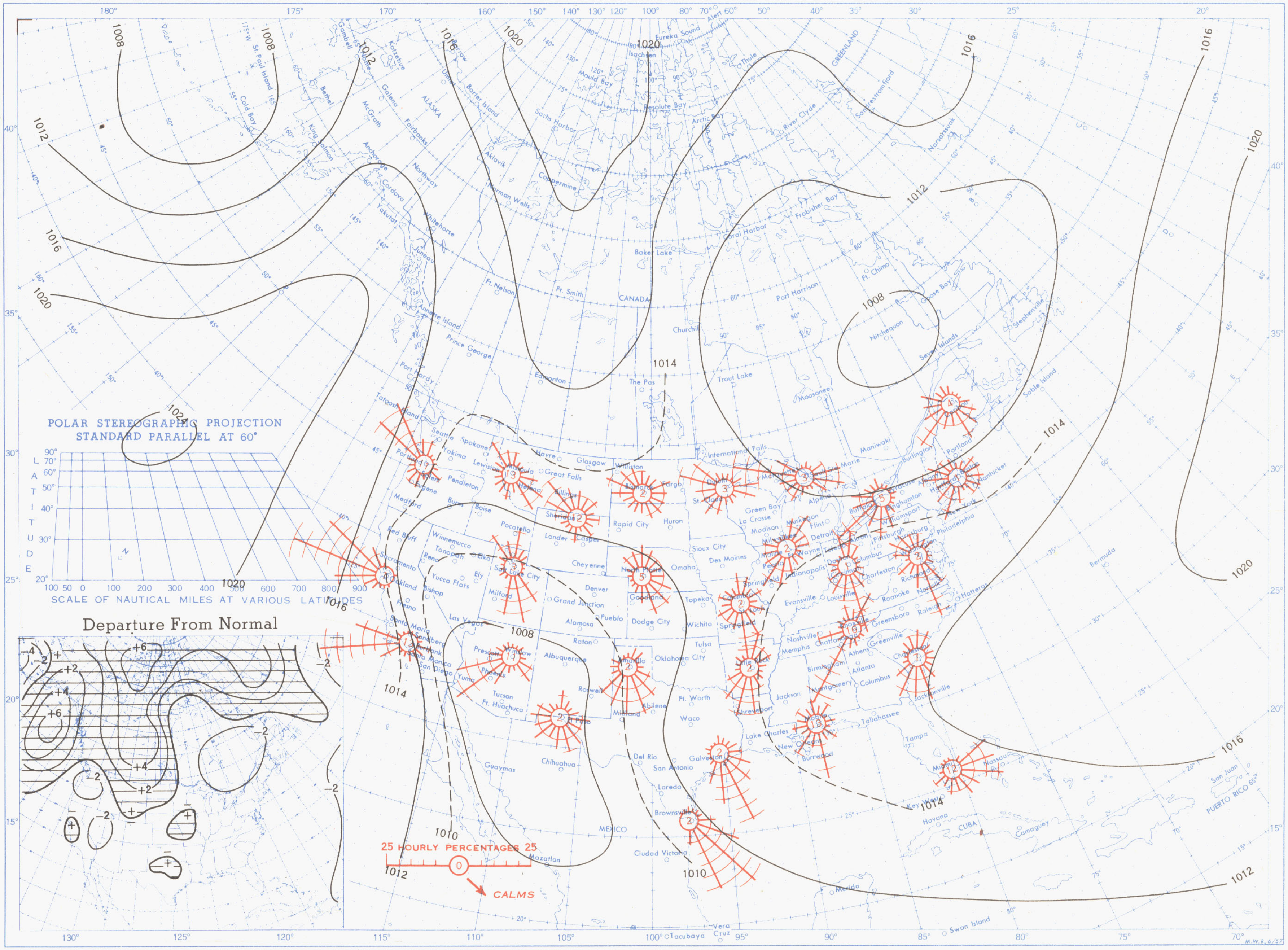
Circle indicates position of center at 7:00 a.m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart X. Tracks of Centers of Cyclones at Sea Level, June 1958.



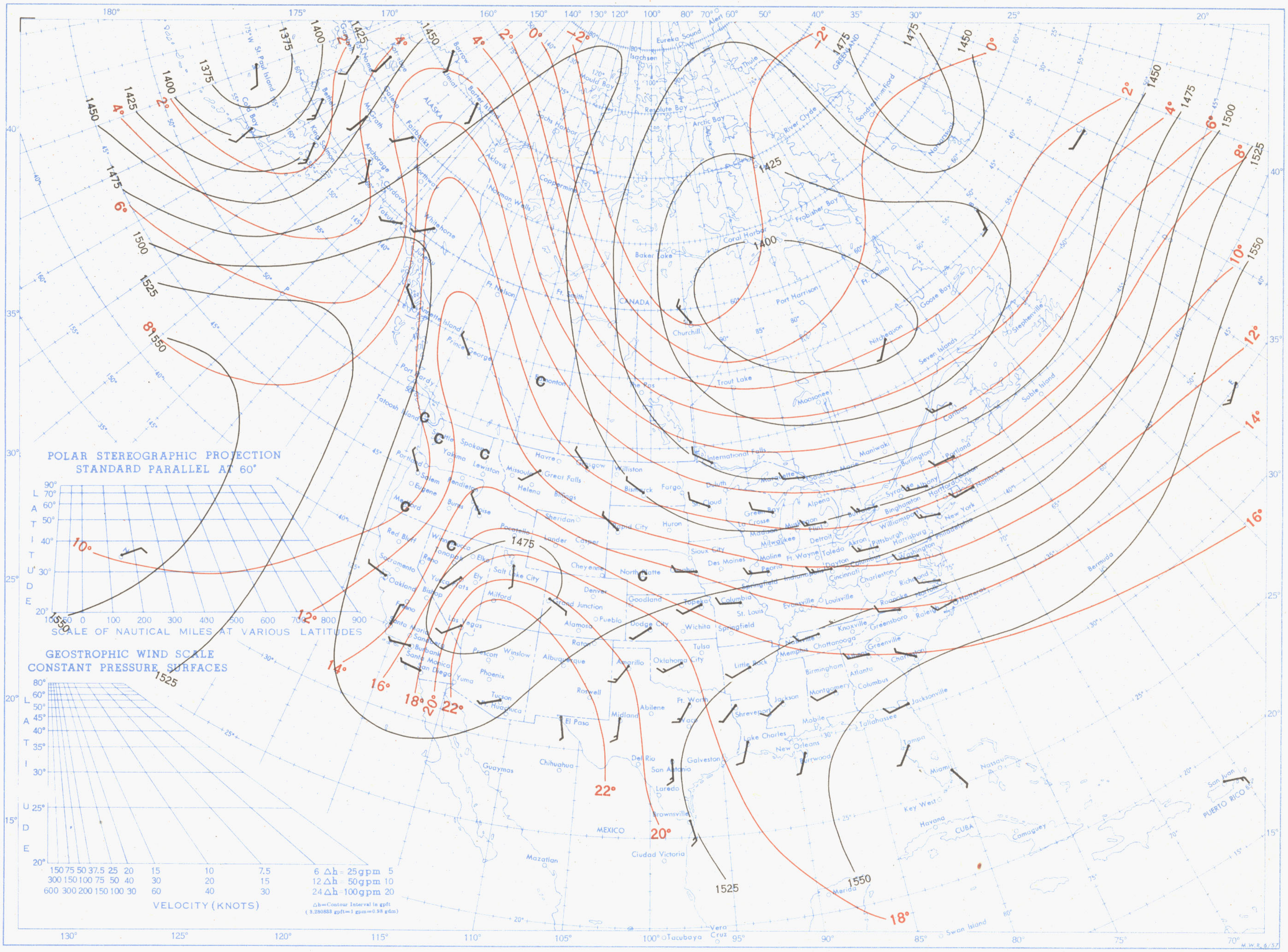
Circle indicates position of center at 7:00 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, June 1958. Inset: Departure of Average Pressure (mb.) from Normal, June 1958.



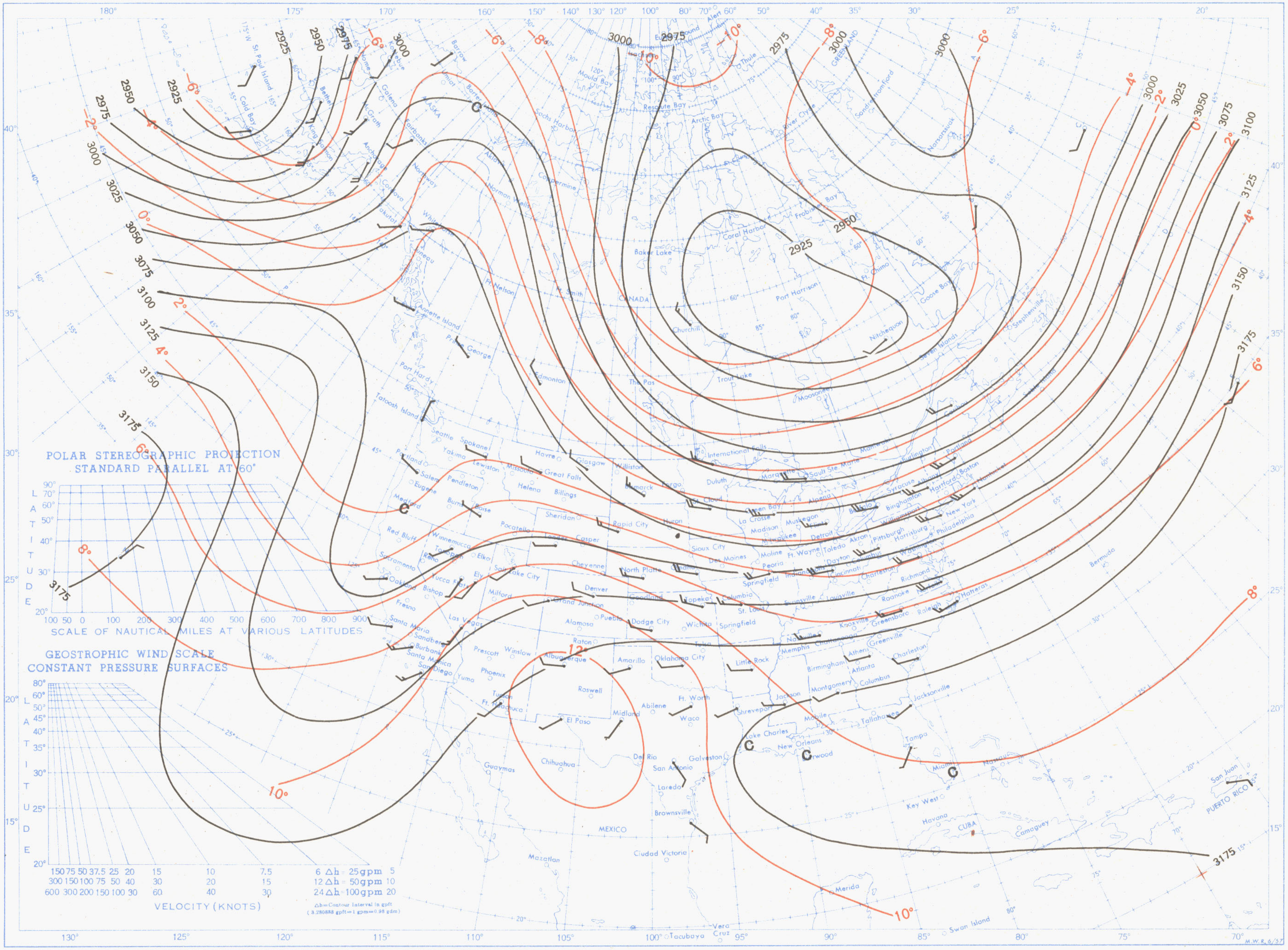
Average sea level pressures are obtained from the averages of the 7:00 a. m. and 7:00 p. m. E. S. T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. 850-mb. Surface, 1200 GMT, June 1958. Average Height and Temperature, and Resultant Winds.



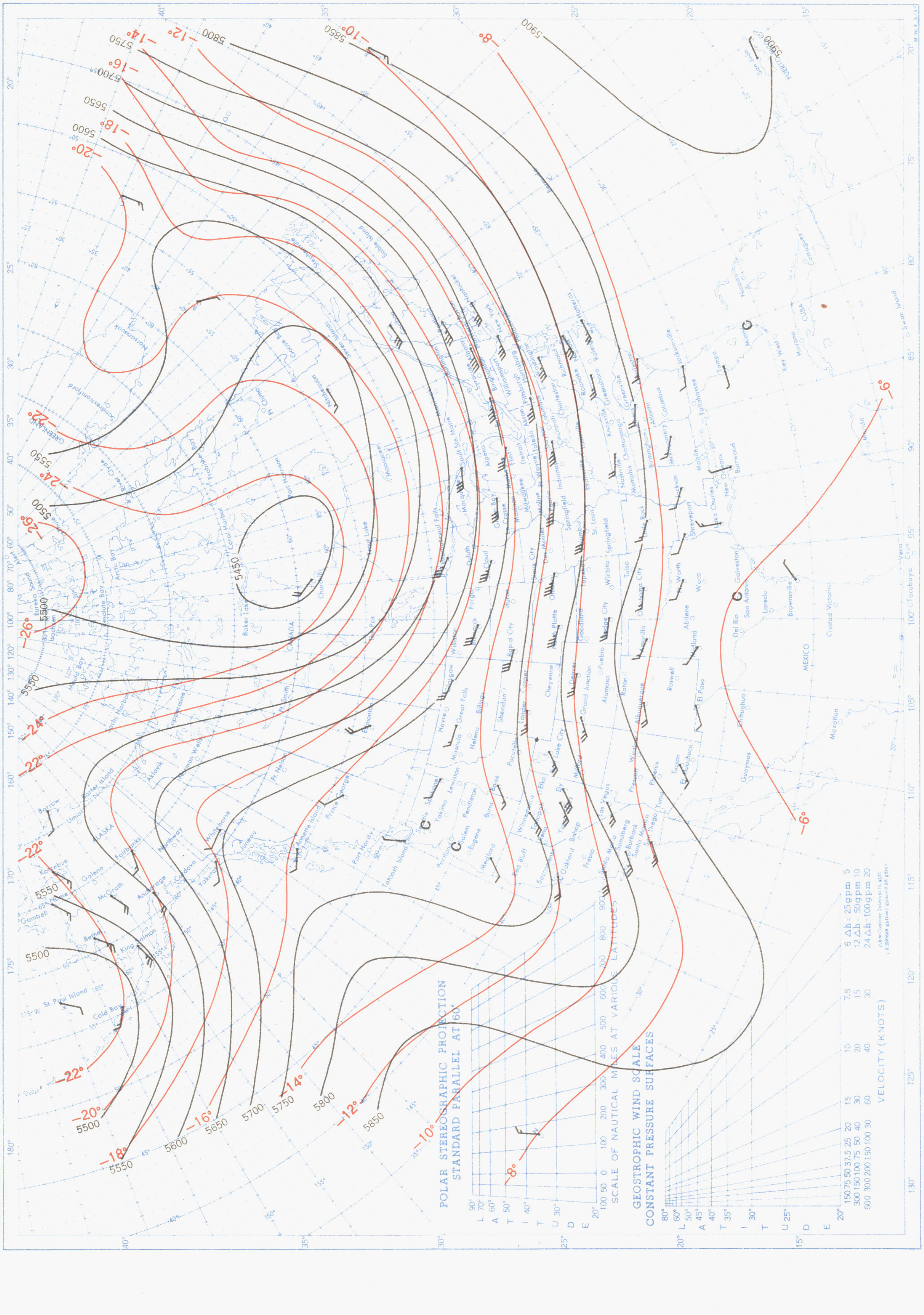
Height in geopotential meters (1 g.p.m. = 0.98 dynamic meters). Temperature in °C. Wind speed in knots; flag represents 50 knots, full feather 10 knots, and half feather 5 knots. All wind data are based on rawin observations.

Chart XIII. 700-mb. Surface, 1200 GMT, June 1958. Average Height and Temperature, and Resultant Winds.



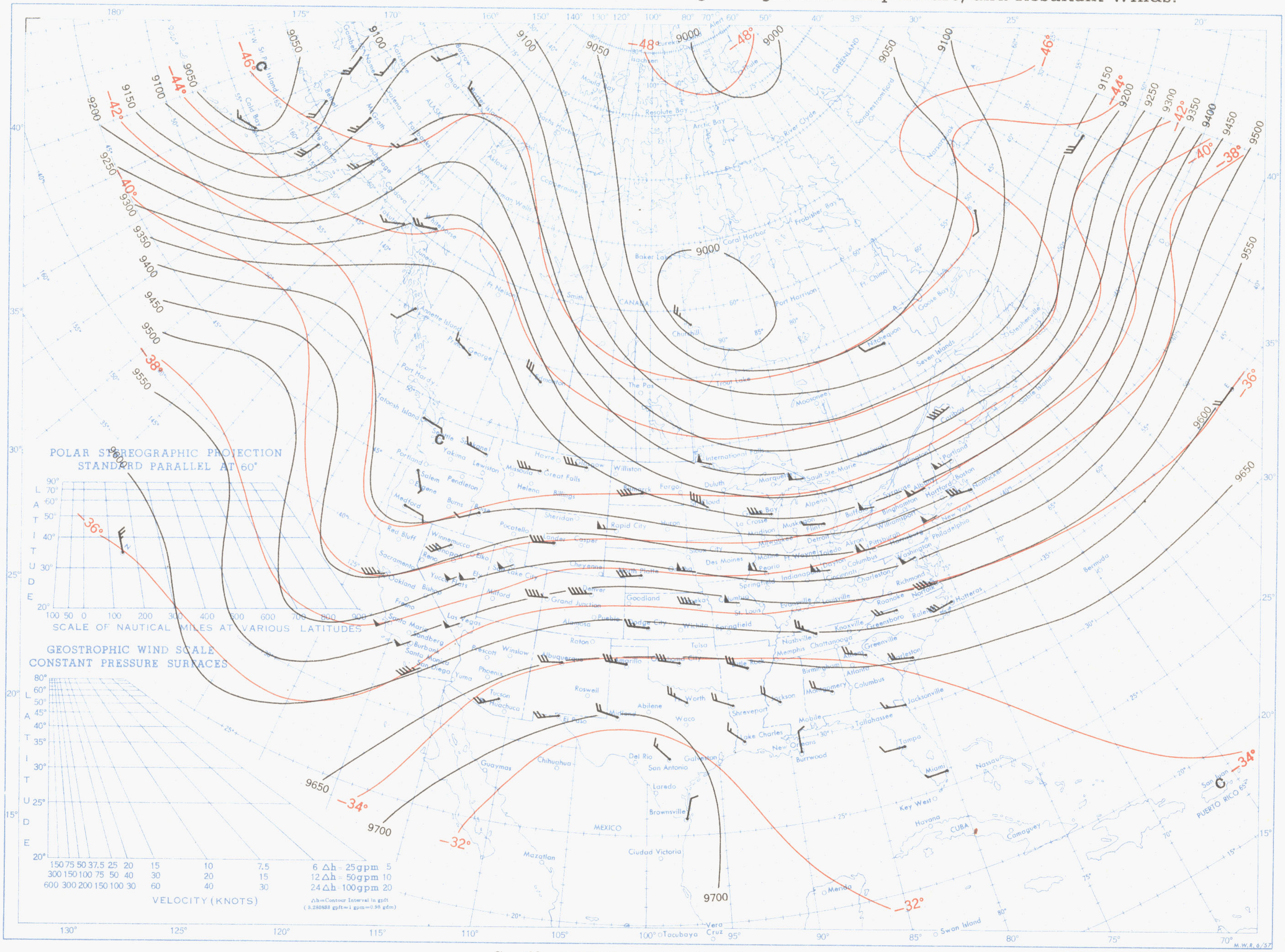
See Chart XII for explanation of map.

Chart XIV. 500-mb. Surface, 1200 GMT, June 1958. Average Height and Temperature, and Resultant Winds.



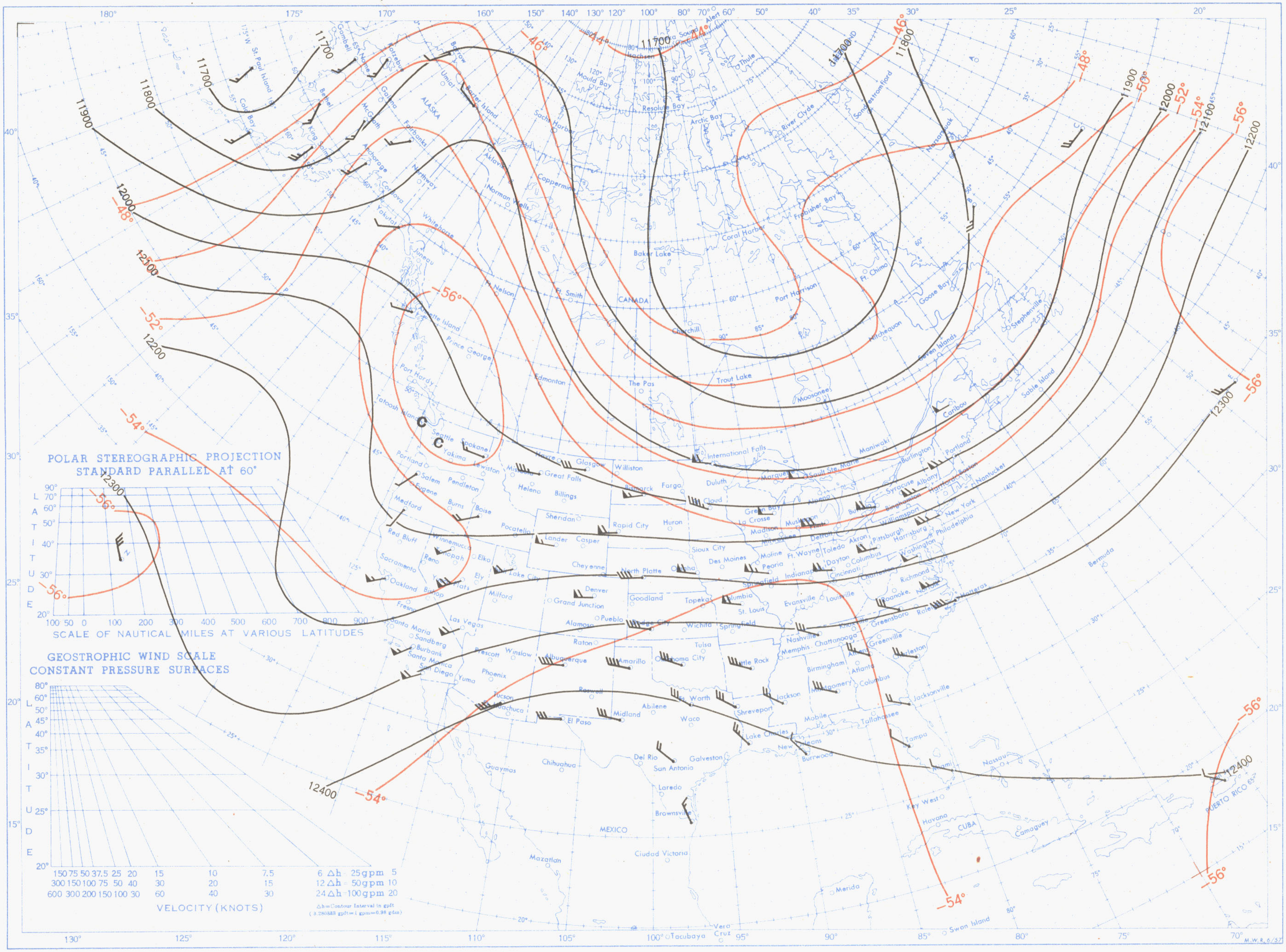
See Chart XII for explanation of map.

Chart XV. 300-mb. Surface, 1200 GMT, June 1958. Average Height and Temperature, and Resultant Winds.



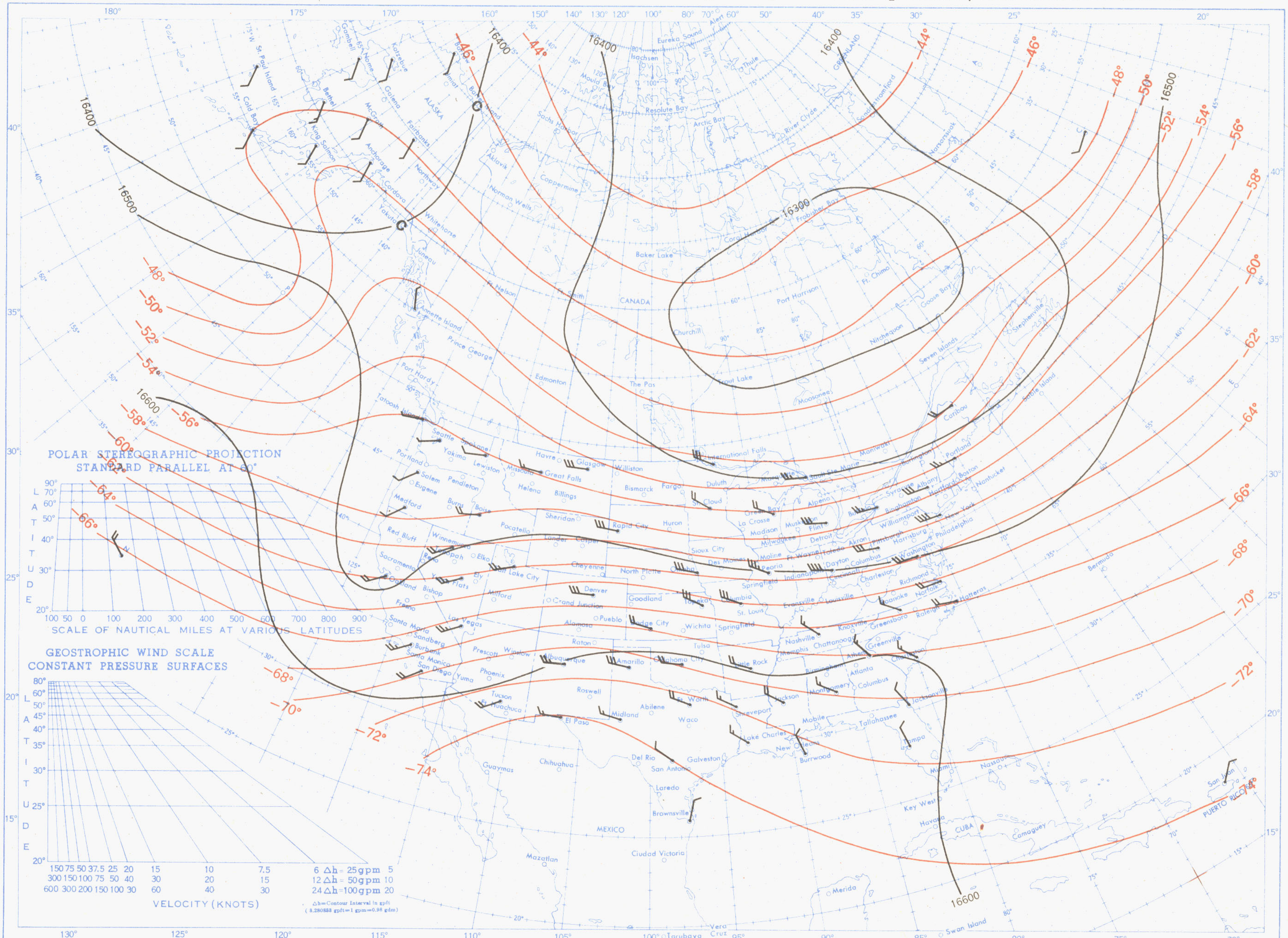
See Chart XII for explanation of map.

Chart XVI. 200-mb. Surface, 1200 GMT, June 1958. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map.

Chart XVII. 100-mb. Surface, 1200 GMT, June 1958. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map.